Cold Weather Injury Prevention and Treatment

Terminal Learning Objective

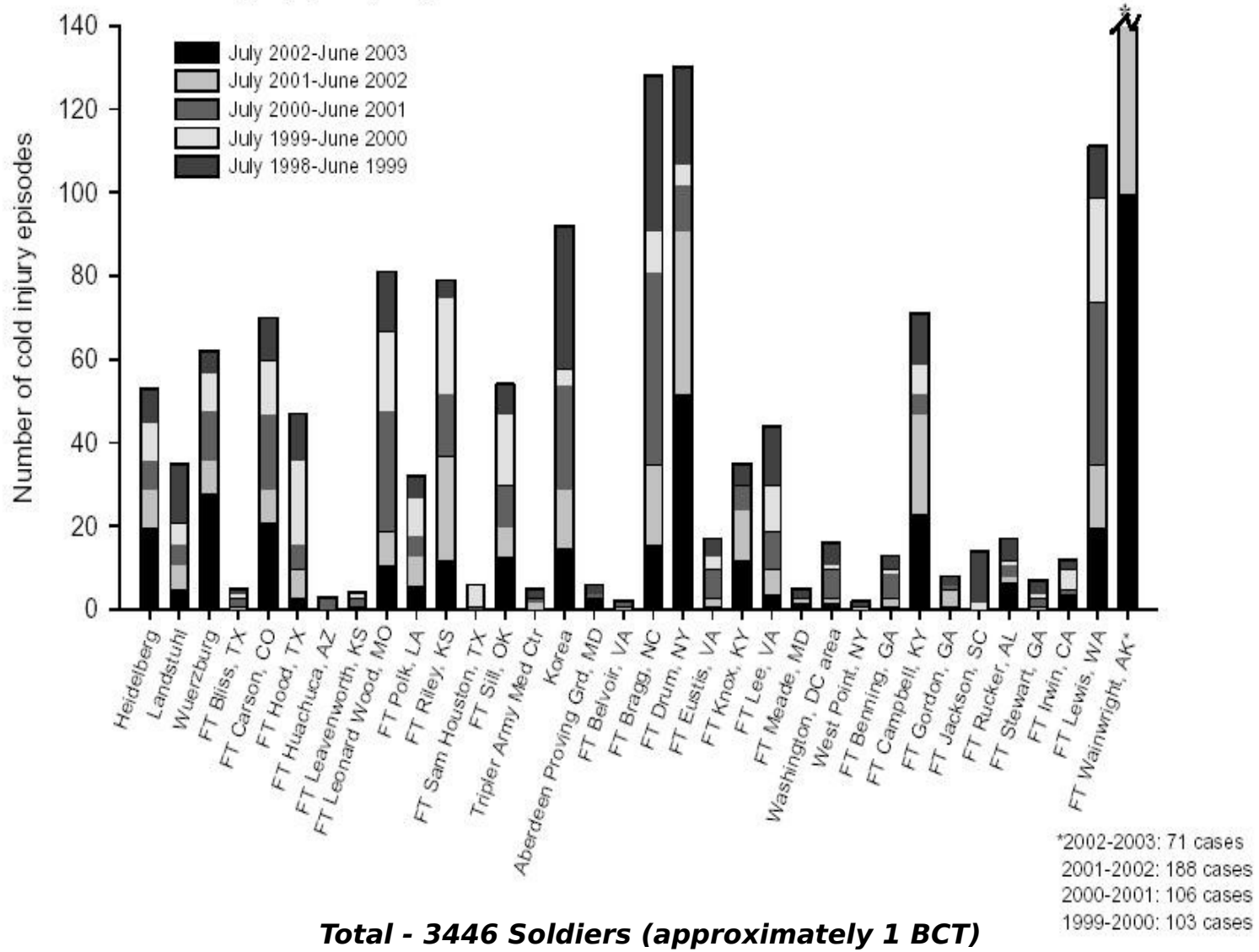
Action: Protect yourself and your fellow Soldiers from cold weather injuries

Condition: You are a Soldier deployed to the field in conditions that range from 50° to -60° F. You are given the Extended Cold Weather Clothing System (ECWCS), other issued cold weather clothing items, the issued cold weather sleep system with insulating pad, access to a warming shelter, and the requirement to protect yourself and your fellow Soldiers against cold weather injuries.

Standard: Apply preventive medicine countermeasures to prevent cold weather injuries. Perform first aid for cold weather

Cold Weather Injuries

Figure 2. Cold injury episodes, by installation/location, active duty, US Army by year, July1998-June 2003.



Total - 3446 Soldiers (approximately 1 BCT)

Environmental Risk Factors

- What is the weather doing?
- What will it do?
- What are the current and forecast temperatures and wind speeds?
- What is the wind chill temperature?

Wind Chill Chart

AIR TEMPERATURE IN FAHRENHEIT

WIND SPEED	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95

WCT (°F) = 35.74 + 0.6215T - 35.75(V0.16) + 0.4275T(V0.16)
Where T is temperature (°F) and V is wind speed (mph)

WIND SPEED BASED ON MEASURES AT 33 FEET HEIGHT. IF WIND SPEED MEASURED AT GROUND LEVEL, BY 1.5 TO OBTAIN WIND SPEED AT 33 FEET IN HEIGHT AND THEN UTILIZE CHART.

Mission Risk Factors

- How intense is the workload for this mission/training?
- How long will you and your Soldiers be exposed?
- What is the availability of heated shelters, cold weather clothing and equipment, food and water?

Individual risk factors

- How does your body regulate heat (heat gain vs. heat loss)?
- How does your body respond to the cold weather environment?
- What types of cold weather injuries can you sustain and how do you treat them?
- What other individual factors make you more or less susceptible to cold weather injuries?

How does your body regulate heat?

Type of heat gain	Type of heat loss
Basal metabolism: your body consumes energy at rest to sustain life	**Radiation: normal heat loss to the environment**
Exercise metabolism: your body consumes energy to sustain activity	**Convection: Cooling effect of air moving across your skin (wind chill)**
You can gain heat from external sources such as sun, fire, etc.	**Conduction: Heat transfer from warm object to a cold object**
	Evaporation: Sweat evaporates and cools your body

How does your body respond to the cold weather environment?

- Shell/Core Effect – body pulls blood from extremities in an effort to keep the core warm.
- Cold Diuresis – result of the shell/core effect; body rids itself of fluid (increased urination), because the kidneys sense an increase of volume in the core; thirst mechanism is also disrupted
- Shivering – involuntary reaction of skeletal muscles which produces heat

What other individual factors make you more or less susceptible to cold weather

Body composition	Long and lean more susceptible than short and fat
Age, gender and race	Females are twice as likely to sustain cold weather injuries. Darker skinned individuals are four times more likely. Individuals over age 35 are more susceptible.
Fitness level	• fitter Soldiers can work for longer periods before fatigue set in • fatigue leads to cold weather injuries
Experience level in the cold	Young male Soldiers, from warm climates with less than eighteen months of service are at greatest risk.
Level of training	Minimum training is ALIT
Drugs and alcohol	• tobacco increases vasoconstriction – less blood flow to the extremities equals greater risk of frostbite • alcohol gives a false sense of warmth • some prescription drugs
Diseases and injuries	• Consider patient packaging for evacuation • Raynaud's syndrome; poor circulation, diabetes
Prior cold weather injuries	Individuals who have sustained frostbite, chilblain and/or immersion foot are more susceptible

What types of cold weather injuries can you sustain and how do you treat them?

Chilblain

- Non-freezing cold weather injury
- Occurs in cold-wet conditions below 50° F
- Small, red, itchy or painful lesions appear on the skin
- No long lasting effects

How do I treat chilblain?

- Re-warm the affected part using skin to skin contact.
- DO NOT rub or massage affected areas.
- DO NOT place the affected part close to a direct heat source.
- Contact medical personnel for further evaluation.

Frostbite

- Frozen body tissue; usually the extremities – hands, face, ears, feet and (rarely) eyes.
- Ambient air temperature must be below 32° F for frostbite to occur.
- Gradual onset progressing from painful, tingling sensation to cold and numb OR
- Contact frostbite from super-cooled objects or liquids such as fuel.
- Identify frostbite as superficial or deep.

Superficial Frostbite

Involves the upper layer(s) of skin only

Skin is:

- white, waxy and pale in lighter skin types
- red, pale or darkened in darker skin types
- numb
- moves over underlying layers
- relatively soft and pliable

Superficial
Frostbite

Superficial
Frostbite

Superficial Frostbite

How do I treat superficial frostbite?

- Re-warm the affected part using skin to skin contact *OR*
- Submerge the affected part in water heated to 104-108° F.
- Administer ibuprofen immediately.
- DO NOT ALLOW THE INJURY TO RE-FREEZE!
- DO NOT rub or massage the affected area.
- DO NOT place the affected part close to a heat source.
- DO NOT allow tobacco or alcohol use.
- Apply Aloe.
- Contact medical personnel for further evaluation/evacuation.

Deep Frostbite

- Can be down to and include the bone
- Blisters (blebs) often form after re-warming
- Skin is:
  - similar in coloration to superficial frostbite
  - not pliable – dents when you push on it
  - patient describes ‘wooden’ feeling
  - pale white and frozen solid in extreme cases

How do I treat deep frostbite?

- Treatment steps are the same as for superficial frostbite (if you can guarantee the injury will not re-freeze).
- Protect blebs with dry sterile dressings.
- Cover ruptured blebs with antibiotic ointment and a sterile dressing.
- Contact medical personnel for further evaluation and evacuation.
- If there is a possibility that the injury will re-freeze during evacuation, you may elect to leave it frozen until the casualty reaches definitive care.

Immersion Syndrome

- **Non-freezing cold weather injury that usually involves the feet.**
- **Also known as immersion foot or trench foot.**
- **Requires prolonged exposure to cold-wet conditions - at least 12 hours but usually 4-5 days.**
- **Blood flow is reduced to the extremity by the cold.**
- **Foot is cold to touch, with some swelling, and is white or bluish; may be numb.**
- **Upon re-warming there is swelling; the foot will be red and blisters may form accompanied by tingling pain that is often severe.**
- **Symptoms can last for weeks to months and include tingling, creeping pain, increased sensitivity to cold and increased perspiration of the foot.**

How do I treat immersion syndrome?

- Re-warm the affected part by gradually exposing to warm air.
- Submerge the affected part in water heated to 104-108° F.
- Clean and dry the affected part carefully.
- Administer ibuprofen immediately.
- DO NOT rub or massage affected areas.
- DO NOT place the affected part close to a direct heat source.
- DO NOT allow tobacco or alcohol use.
- DO NOT allow the individual to walk on the injury.
- Contact medical personnel for further evaluation.

Hypothermia

- Body core temperature falls below 95° F from exposure to cold conditions
- Onset is more likely if you are dehydrated, are not eating properly and/or are over fatigued
- Cold-wet conditions are most likely to bring on hypothermia
- Cold water immersion can induce hypothermia
- Varying degrees of hypothermia:
  - Mild hypothermia
  - Moderate hypothermia
  - Severe hypothermia
- ***Hypothermia is a medical emergency!***

Hypothermia

Mild Hypothermia Body core temperature: 90-95° F	Moderate Hypothermia Body core temperature: 80-89° F	Severe Hypothermia Body core temperature below 80° F
• Shivering • “Umbles”: stumbles, fumbles, grumbles and mumbles • lack of sound judgment, confusion, apathy • increased heart rate • increased respiratory rate • Pale, cool skin	• Uncontrollable shivering • Worsening of the “umbles” • Increased confusion • Increased heart and respiratory rates • Cold and pale skin	• shivering stops • muscle rigidity • stupor progressing to unconsciousness • Slowed breathing and heart rate (may not be able to find a pulse) • Cold, bluish skin

How do I treat hypothermia?

Mild and Moderate Hypothermia	Severe Hypothermia
Get the casualty to a warm and dry environment.	Handle with care – rough treatment may cause heart to stop.
Replace damp clothing with dry clothing.	Use supplemental O2 or begin rescue breathing if breathing has stopped or is barely detectable.
Add extra insulation under and around the casualty.	Get the casualty into a warm and dry environment.
Provide food and warm liquids.	Carefully remove damp/wet clothing.
Exercise (mild cases where the patient still has muscle control only).	Package in a hypothermia wrap.
Package moderately hypothermic patients in a hypothermia wrap.	Evacuate using the gentlest means available.

Questions?

Risk Of Frostbite

WIND SPEED	AIR TEMPERATURE IN FAHRENHEIT											
	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	>2H	>2H	>2H	>2H	31	22	17	14	12	11	9	8
10	>2H	>2H	>2H	28	19	15	12	10	9	7	7	6
15	>2H	>2H	33	20	15	12	9	8	7	6	5	4
20	>2H	>2H	23	16	12	9	8	8	6	5	4	4
25	>2H	42	19	13	10	8	7	6	5	4	4	3
30	>2H	28	16	12	9	7	6	5	4	4	3	3
35	>2H	23	14	10	8	6	5	4	4	3	3	2
40	>2H	20	13	9	7	6	5	4	3	3	2	2
45	>2H	18	12	8	7	5	4	4	3	3	2	2
50	>2H	16	11	8	6	5	4	3	3	2	2	2

GREEN-LITTLE DANGER (frostbite occurs in >2H in dry exposed skin)

YELLOW - INCREASED DANGER (frostbite could occur in 45 minutes or less in dry, exposed skin)

RED- GREAT DANGER (frostbite could occur in 5 minutes or less in dry exposed skin)

Time to occurrence of frostbite in the most susceptible 5% of personnel. Wet skin could significantly decrease the time for frostbite to occur

What is the risk level for cold weather injury?

Risk Assessment Matrix					
	Probability				
Severity	**Frequent A**	**Likely B**	**Occasional C**	**Seldom D**	**Unlikely E**
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**
E –Extremely High H – High M – Moderate L - Low					

What controls can I put in place to prevent cold weather injuries?

Resources:

- *USARAK 385-4, Appendix A: Temperature Zone Guidance*
- *U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) website*
- *U.S. Army Research Institute of Environmental Medicine (USARIEM) website*

What are some general guidelines for implementing these controls?

Wear the uniform properly.

Drink 3.5-5 quarts of water per day.

Eat 4,500-6000 calories per day.

Do not wear skin camouflage below 32° F.

Shave prior to the rest cycle.

Field Sanitation.

Cold Weather Uniform TTPs

The cold weather uniform should:

- *Keep you warm*
- *Keep you dry*
- *Protect you from the wind*
- *Provide ventilation*

Extended Cold Weather Clothing System Overview

Base Layer – also known as inner or wicking layer, the base layer(s) are designed to wick excess moisture away from your body.

Insulation Layer – intermediate layer(s) that provides volume to enable you to trap warm air between your body and outer garments

Outer Shell Layer – external layer that protects you from the elements providing protection from wind and moisture

Clothing Guidelines

C- ***Keep it Clean***

O- ***Avoid Overheating***

L- ***Wear clothes Loose and Layered***

D- ***Keep clothing Dry***

C- Keep it Clean

Dirt and grease reduce the insulating properties of clothing

Clean whenever possible

Dry rub clothing in the field

O*- *Avoid Overheating

Don't overdress

Causes excess perspiration

Dampness reduces insulating properties of clothing

Perspiration evaporates, cooling the body

L*-*Wear clothes Loose and Layered

Tight clothing restricts circulation

Restricts movement

Lessens volume of trapped air

D- *Keep clothing Dry*

Moisture enters from both outside and inside

Damp clothing reduces insulating properties and cools your body faster

Brush snow off clothing before entering heated shelter

Air dry clothing away from direct heat source

Dry leather items slowly

How do I wear the Generation II ECWCS?

GEN II ECWCS: Base Layer

Polypro undershirt and drawers:

- **Wear next to skin**
- **DO NOT wear cotton undergarments under polypro**
- **Standard issue is shown; lightweight and mid-weight are available and may be issued**
- **Worn with single wool sock or two sock system**

GEN II ECWCS: Insulation Layer

- **Polar Fleece Shirt**
- **Polar Fleece Overalls**
- **IAW USARAK Pamphlet 600-2, the black fleece WILL NOT be worn as an outer garment.**

GEN II ECWCS: Insulation Layer

Liners, Cold Weather – Coat and Trousers:

- **Wear over base layer**
- **Same material as poncho liner**
- **Coat has slits under arm for ventilation**
- **Trousers are sized short intentionally**

Gen II ECWCS: Outer Shell Layer

- **Wear GORE-TEX® over base and insulation layers or over base layer for heavier activity levels**
- **Wear the GORE-TEX® trousers with suspenders**
- **GORE-TEX® water repellency can be restored**
- **Three balaclava configurations**
- **Three neck gaiter configurations**
- **Boots issued in basic training are NOT for cold weather**
- **Below 14º F, you should wear the white VB boot**
- **Always wear a contact glove when temperatures are below 32º F**

How do I wear the Generation III ECWCS (a.k.a the Seven Layer System)?

Generation III ECWCS Level 1: Base Layer

Lightweight Cold Weather Undershirt and Drawers

Long sleeve top and full-length bottom constructed from silkweight moisture wicking polyester

Material aids in movement of moisture from the skin to the outer layers

Generation III ECWCS Level 2: Base Layer

Mid-Weight Cold Weather Shirt and Drawers

Long sleeve top and full-length bottom garments constructed out of polyester ‘grid’ fleece

Grid fleece provides an increase of surface area for transportation of moisture away from the wearer during movement

Can be worn next to skin or

Generation III ECWCS Level 3: Insulation Layer

Fleece Jacket is the primary insulation layer for use in moderate to cold climates.

Thermal Pro, animal fur mimicking insulation provides an increase in warmth to weight ratio along with a reduction in volume when packed.

Authorized for use as an outer garment in USARAK. Not authorized for use as an outer garment during NWTC courses.

Generation III ECWCS Level 4: Outer Shell

Wind Cold Weather Jacket is made of a lightweight, windproof and water repellant material

Acts as a minimum outer shell layer, improving the performance of moisture wicking layers when combined with Body Armor and/or the ACU

Generation III ECWCS Level 5: Outer Shell

Soft Shell Cold Weather Jacket and Trousers

Made of a highly water resistant, wind proof material that increases moisture vapor transfer

Increased breathability improves performance of insulation layers by decreasing saturation due to moisture vapor accumulation

Provides a reduction in weight, bulk and noise signature during movement

Best used when temperature is below 14º F

Generation III ECWCS Level 6: Outer Shell

Extreme Cold/Wet Weather Jacket and Trousers

A waterproof layer for use in prolonged and/or hard rain and cold wet conditions

Best used when temperatures are above 14º F and alternating between freezing and thawing

Generation III ECWCS Level 7: Outer Shell

Extreme Cold Weather Parka and Trousers

Provides superior warmth with low weight, and low volume

Highly water-resistant and windproof in order to provide wind and moderate moisture protection

Sized to fit over body armor

For extreme cold weather climates; the outer most layer of protection. Meant for static positions

Modular Sleep System (MSS)

The complete MSS system weighs about 7 pounds and includes:

- **Patrol Bag is rated 50º F to 30º F**
- **Intermediate Cold Weather Bag is rated 30º F to -10º F**
- **Vapor Permeable GORE-TEX® Bivouac Cover**
- **Intermediate Cold Weather bag goes inside the Patrol Bag which goes inside the Bivouac Cover. This provides protection from -10º F to -40º F for 4 hours of sleep.**

How do I care for ECWCS?

- Before laundering make sure all zippers are zipped and all snaps and hooks are fastened. Tie draw cords together.
- For MSS use front load washing machine
- Machine launder using delicate/gentle fabric cycle or by hand.
- Use lukewarm water (90º F) and cold water laundry detergent
- Rinse in clean cold water.
- Tumble dry. Do not exceed temperatures of 130º F as degradation of component materials will occur. For Level VI, set on permanent press.
- Avoid over drying.
- To drip dry, place on a rust proof hanger
- Do not press; Do not starch; Do not use fabric softeners; Do not bleach.

What are some movement TTPs?

- Start movements comfortably cool.
- Adjust movement rate to prevent profuse sweating.
- Take a brief halt, 10-15 minutes after movement begins to adjust clothing.
- Keep clothing upgrade items easily accessible – adjust on the move.
- Carry a minimum of 2 quarts of water.
- Drink and eat on the move.
- Take a brief 5-10 minute halt every hour; long halts lead to injury.
- For vehicle movements, where you are exposed, cover all exposed skin and wear eye protection.

FIX COLD CHALLENGES IMMEDIATELY!

If you suspect that you or someone else has or are developing a cold weather injury, you must correct the problem immediately:

- Remove wet clothing and replace with dry clothing.
- Upgrade clothing as required.
- Exercise using total body movements.
- Eat and hydrate.
- Get into a heated shelter if possible.

Cold Weather PT Policy

Follow guidelines set forth in USARAK CG/CofS Policy Letter #0-08: Cold Weather Physical Training Policy.

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